UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,664	02/05/2004	Yun Luo	TRW(TE)6895	5569

26294 7590 10/26/2007

TAROLLI, SUNDHEIM, COVELL & TUMMINO L.L.P.
1300 EAST NINTH STREET, SUITE 1700
CLEVEVLAND, OH 44114

EXAMINER	
FUJITA, KATRINA R	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
10/26/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/772,664	LUO ET AL.	
	Examiner	Art Unit	
	Katrina Fujita	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17 and 19-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17 and 19-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *03/23/2007*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to Applicant's remarks received on August 13, 2007. Claims 1-17 and 19-26 remain pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 16, 17, 19-23, 25, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Murphey et al. ("Feature Extraction for a Multiple...", IEEE Article).

Regarding **claim 16**, Murphey et al. discloses a method for classifying image data into one of a plurality of output classes comprising the steps of:

establishing a classifier grid model ("dynamic grids generation algorithm" at page 221, left column, line 4) associated with a pattern recognition classifier ("Each class of pattern has its own type of feature vectors defined by the grids and has its own classifier" at section 2, paragraph 2, line 5) from a composite image ("generates a feature image for every class of patterns" at page 221, left column, line 5) formed from a plurality of training samples belonging to at least one output class represented by the pattern recognition classifier ("k sets of training images, Tr_1, Tr_2, ..., Tr_k, where images in Tr_i belong to class i" at section 2, paragraph 2, line 1);

imaging an unknown object to create an input image ("unknown pattern image" at page 222, left column, line 2);

overlaying the classifier grid model over the input image ("superimposing the grids to the image at page 221, right column, fourth full paragraph, line 5) to produce a plurality of sub-images ("subimages" at page 221, right column, fourth full paragraph, line 6);

extracting feature data from the plurality of sub-images ("computing the features from subimages" at page 221, right column, fourth full paragraph, line 6); and

classifying the unknown object from the extracted feature data ("integrates the output from all the neural network classifiers to produce a final classification result" at page 222, left column, line 13).

Regarding **claims 17 and 19**, Murphey et al. discloses a method wherein the step of establishing a classifier grid model includes:

generating a representative image that represents at least one output class associated with the classifier ("step 3", page 221, left column);

dividing the representative image according to an initial grid pattern to form a plurality of sub-images ("divided the class feature image, say feature_image_cl_i for class i, into a coarse scale subimages" at page 221, right column, line 13);

identifying at least one sub-image formed by said grid pattern having at least one attribute of interest ("looks for the subimage j that has the greatest energy" at page 221, right column, second full paragraph, line 6); and

modifying said grid pattern in response to the identified at least one sub-image having said at least one attribute of interest so as to form a modified grid pattern wherein the step of modifying the grid pattern includes modifying the grid pattern to divide the identified sub-images into respective pluralities of sub-images ("Once the subimage j is found and assume the subimage has size $2^{kj}X2^{kj}$, then the subimage j is divided into 4 new subimages" at page 221, third full paragraph, line 1).

Regarding **claims 20 and 21**, Murphey et al. discloses a method wherein the steps of identifying at least one sub-image and modifying the grid pattern in response to the identified sub-image are repeated iteratively until a termination event is recorded, wherein the termination event comprises producing a modified grid that divides the class composite image into a threshold number of sub-images ("The above process

repeats until the number of subimages exceeds a preset number" at page 221, right column, third full paragraph, line 3).

Regarding **claim 22**, Murphey et al. discloses a method wherein extracting feature data from the plurality of sub-images includes extracting a set of at least one feature value from each sub-image, such that each sub-image provides an equal number of feature values to an associated feature vector ("The dimension of the feature vector should be equal to the number of grids generated by the dynamic grid finding algorithm and each element in the feature vector is calculated from a subimage" at page 221, right column, fourth full paragraph, line 7).

Regarding **claim 23**, Murphey et al. discloses a method wherein the at least one feature value includes an average grayscale value associated with each sub-image ("gray scale intensity images" at page 221, left column; "average value of each subimage" at page 221, right column, fourth full paragraph, line 12).

Regarding **claim 25**, Murphey et al. discloses a method wherein the at least one feature value includes a contrast measure associated with each sub-image ("If the training images were gradient images, then only the pixels with large positive values represent significant areas for that class" at page 221, left column).

Regarding **claim 26**, Murphey et al. discloses a method wherein imaging an unknown object includes imaging an occupant of a passenger seat within a vehicle ("classify occupant inside a vehicle" at section 3, line 3).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 1, 2, 4-7, 10-14, are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al. (US 6,801,662) and Murphey et al.

Regarding **claim 1**, Owechko et al. discloses a system for classifying an input image into one of a plurality of output classes ("systems and methods for detection and classification of objects for use in control of vehicle systems, such as air bag deployment systems" at col. 1, line 8) comprising

a plurality of pattern recognition classifiers (figure 1, numerals 135, 145, 155), each pattern recognition classifier operative to process feature data associated with the input image to determine an associated output class of the input image ("operate on the feature data to classify the occupant into one of a small number of classes" at col. 4, line 49); and

a plurality of feature extractors (figure 1, numerals 110, 120, 130, 140), each feature extractor extracting feature data from the input image for an associated one of the plurality of pattern recognition classifiers ("Feature extraction modules 110, 120,

130, and 140 receive and process frames from the stream of images 105 to provide feature data" at col. 4, line 46).

Owechko et al. does not disclose that each feature extractor applies a fixed grid pattern associated with its associated classifier to the input image, wherein the applied fixed grid pattern is constant at each feature extractor and differs among the plurality of feature extractors, to extract feature data from the input image for the associated pattern recognition classifier.

Murphey et al. teaches a system for classifying an input image ("multiple pattern classification neural network system has been applied to...occupant classification" at section 1, paragraph 3, line 9) into one of a plurality of output classes ("four different classes of patterns, adult, child, empty seat and rear facing infant seat (Rfis)" at section 3, line 4) comprising

a plurality of feature extractors (figure 1, blocks labeled "Feature vector generation"), each feature extractor being associated with one of the plurality of pattern recognition classifiers (figure 1, blocks labeled "NN classifier 1...m"), each feature extractor applying a fixed grid pattern associated with its associated classifier to the input image ("dynamic grids generation algorithm" at page 221, left column, line 4), wherein the applied fixed grid pattern is constant at each feature extractor and differs among the plurality of feature extractors ("for different pattern classes, the algorithm generated different pattern grids" at page 221, last sentence), to extract feature data from the input image for the associated pattern recognition classifier ("generates a feature image for every class of patterns" at page 221, left column, line 5).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the feature extractors of Murphey et al. in the extraction modules of Owechko et al. to "provide more details in the more important areas of the pattern" (Murphey et al. at page 221, last sentence).

Regarding **claim 2**, Murphey et al. teaches a system wherein a given feature extractor applies the classifier grid pattern representing its associated classifier to the input image to produce a plurality of sub-images ("divided the class feature image, say feature_image_cl_i for class i, into a coarse scale subimages" at page 221, right column, line 13), the feature extractor extracting feature data relating to each of the plurality of sub-images ("computing the features from subimages defined by these grids" at page 221, fourth full paragraph, line 6).

Regarding **claim 4**, Owechko et al. discloses a system wherein at least on of the plurality of pattern recognition classifiers includes an artificial neural network ("an NDA network is used to generate class confidences" at col. 10, line 57).

Regarding **claims 5 and 6**, Owechko et al. discloses a system further comprising an image source that provides the input image wherein the image source includes a stereo camera system ("Means for capturing images of an area may comprise CMOS or CCD cameras" at col. 3, line 10; "stereo imaging system" at col. 7, line 58).

Regarding **claim 7**, Owechko et al. discloses a system further comprising an arbitrator associated with the plurality of pattern recognition classifiers that evaluates a plurality of outputs associated with the classifiers and determines an associated output class for the input image from the plurality of classifier outputs ("predictions and

confidences of the classifiers are then combined in a sensor fusion engine 170 which makes the final decision" at col. 4, line 56).

Regarding **claim 10**, Owechko et al. discloses a system wherein each of the plurality of classifiers represents at least one associated output class (see rejection of claim 1).

Murphey et al. teaches a system wherein the classifier grid pattern associated with each classifier is derived from training images associated with the at least one associated output class ("k sets of training images, Tr_1, Tr_2, ..., Tr_k, where images in Tr_i belong to class i" at section 2, paragraph 2, line 1).

Regarding **claim 11**, Owechko et al. discloses a system for object classification for use in a vehicle system ("systems and methods for detection and classification of objects for use in control of vehicle systems, such as air bag deployment systems" at col. 1, line 8) comprising

a vision system that images a vehicle interior to provide an input image ("system for detecting and tracking objects within a specified area that can be adapted for detecting and recognizing occupants within a vehicle" at col. 2, line 27; "vision-based system" at col. 2, line 39).

Regarding **claim 12**, Owechko et al. discloses a system wherein at least one of the plurality of output classes represents a human adult seated within the vehicle ("four classifications: adult in normal or twisted position, adult out-of-position (OOP)" at col. 5, line 49).

Regarding **claim 13**, Owechko et al. discloses a system wherein at least one of the plurality of output classes represents a rearward facing infant seat positioned within the vehicle interior ("rear-facing infant seat (RFIS)" at col. 5, line 51).

Regarding **claim 14**, Owechko et al. discloses a system wherein at least one of the plurality of output classes represents a human head ("when an occupant is out of position with a vision based algorithm capable of estimating the occupant position in real time and then tracking dynamically his head" at col. 7, line 34).

6. Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al. and Murphey et al. as applied to claim 1 above, and further in view of Gokturk et al. (US 2004/0153229; hereinafter referred to as Gokturk '229, which incorporates teachings from Gokturk et al. (US 2003/0169906; hereinafter referred to as Gokturk '906)).

Regarding **claim 3**, the Owechko et al. and Murphey et al. combination teach the elements of claim 1 as shown in the 103 rejection above.

The Owechko et al. and Murphey et al. combination does not teach a system wherein at least one of the plurality of pattern recognition classifiers includes a support vector machine.

Gokturk '229 discloses a system in the same field of endeavor of vehicle safety ("relates to intelligent deployment and use of such airbags and safety restraints for vehicles" at paragraph 0002, line 3) wherein at least one of the plurality of pattern

recognition classifiers includes a support vector machine ("images are next fed into a training algorithm such as nearest neighbor classification, support vector machines" in paragraph 0147, line 17).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the classifier modules of the Owechko et al. and Murphey et al. combination using the algorithm taught by Gokturk '229 as described above, to find "the best differentiating hypersurface...that optimally differentiates the data belonging to the particular class C_i, from the rest of the data belonging to any other" (Gokturk '906 at paragraph 0085, line 5).

Regarding **claim 8**, the Owechko et al. and Murphey et al. combination teaches the elements of claim 1 as described in the 103 rejection above.

The Owechko et al. and Murphey et al. combination does not teach an image preprocessor that removes background information and noise from the input image.

Gokturk '906, referenced by Gokturk '229, teaches an image preprocessor that removes background information ("subtracting the background image from the image" at paragraph 0068, line 3) and noise from the input image ("morphological opening operation may be executed to remove the noise" at paragraph 0068, line 13).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the pattern recognition classifier assembly of the Owechko et al. and Murphey et al. combination using the preprocessing taught by Gokturk '229 as described above, to eliminate "unwanted portions of the depth image (or alternatively the intensity image)" (Gokturk '906 at paragraph 0068, line 10).

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al. and Murphey et al. as applied to claims 1 and 11 above, and further in view of Krumm (US 5,983,147).

The Owechko et al. and Murphey et al. combination teaches the elements of claim 11 as described in the 103 rejection above.

The Owechko et al. and Murphey et al. combination does not teach producing three-dimension image data of the vehicle interior as a stereo disparity map.

Krumm teaches producing three-dimension image data of the vehicle interior as a stereo disparity map ("disparity image--one that gives disparity values at every point in the image" at col. 6, line 17).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the vision system of the Owechko et al. and Murphey et al. combination using the disparity map taught by Krumm as described above, to provide "an invariant image for classification" (Krumm at col. 6, line 14) that eliminates the need to "compute range values" (Krumm at col. 6, lines 11-14).

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al., Murphey et al. and Gokturk '229 as applied to claim 8 above, and further in view of Ericksen et al. ("MAHEM: A Multiprocessor...", SPIE article).

The Owechko et al., Murphey et al. and Gokturk combination teach the elements of claim 8 above.

The Owechko et al., Murphey et al. and Gokturk combination does not teach applying a contrast limited adaptive histogram equalization that adjusts the image for lighting conditions.

Ericksen teaches a contrast limited adaptive histogram equalization that adjusts the image for lighting conditions ("Contrast Limited Adaptive Histogram Equalizaton (CLAHE)" in section I, line 3; "sensitivity to the intensity distribution is limited to visually relevant (nearby) intensities" in section III, paragraph 1, line 8).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the image preprocessor of the Owechko et al., Murphey et al. and Gokturk combination using the histogram equalization taught by Ericksen as described above, to not "enhance noise in relatively constant-level areas of the image" (Ericksen at section III, paragraph 4, line 2).

9. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murphey et al. in view of common knowledge in the art as evidenced by Jackway et al. (US 2002/0051571).

Murphey et al. discloses the elements of claim 22 as described in the 102 rejection above.

Murphey et al. does not explicitly disclose that the at least one feature value includes a coarseness measure associated with each sub-image.

However, as shown in the disclosure, depending on the input image type, an appropriate feature type may be employed for optimum results ("For different types of training images, one can use feature image differently" at page 221, left column). The method of Murphey et al. discloses the use of texture images as a possible type of training image ("texture image" at section 2, paragraph 2, line 4).

Accordingly, it would have been obvious at the time the invention was made of one of ordinary skill in the art to use coarseness as a feature value when evaluating texture images as "Image texture can be qualitatively evaluated as having one or more of the properties of fineness, coarseness" (Jackway et al. at paragraph 0004, line 6).

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katrina Fujita whose telephone number is (571) 270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KF

Katrina Fujita
Art Unit 2624

V Bali

VIKKRAM BALI
PRIMARY EXAMINER